patients as these services remain billable (CPT codes 99371-3) and for patients requiring repair for AAA growth during surveillance, documentation of intervention planning from CT images by the surgeon/operator is also reimbursable (CPT G0288). Patients experiencing AAA growth during surveillance managed "centrally" could then be sent back to the referring/assigned providers and their preferred vascular surgeon/"interventionalist" for appropriate AAA treatment. Other common pathological entities that require serial imaging studies (eg, small pulmonary nodules or low probability mammographic breast lesions) could be "centrally" managed by similar surveillance methods with the resource "tools" described in this report. Reduction in the variability of care quality, efficiency of disease management, and improved patient compliance may all result in safer outcomes.

CONCLUSION

Implementation of a clinical pathway for nonoperative management of small AAA (4.0 to 5.4 cm) was associated with high patient compliance, low rupture risk, and extremely low cumulative aneurysm-related mortality. Aneurysm surveillance can be efficiently performed to achieve optimal patient safety and could be associated with long-term resource utilization and cost benefits.

AUTHOR CONTRIBUTIONS

Conception and design: PA, MB, DB
Analysis and interpretation: PA, MB, DB
Data collection: PA, AL, SC, BL, MS
Writing the article: PA, MB
Critical revision of the article: PA, MB, DB, AL, SC, BL, MS
Final approval of the article: PA, MB, DB, AL, SC, BL, MS
Statistical analysis: PA, MB
Obtained funding: Not applicable
Overall responsibility: PA

REFERENCES

1. The UK Small Aneurysm Trial Participants. Mortality results for randomized controlled trial of early elective surgery or ultrasonographic surveillance for small abdominal aortic aneurysms. Lancet 1998;352:1649-55.
2. The UK Small Aneurysm Trial Participants. Long-term outcomes of immediate repair compared with surveillance of small abdominal aortic aneurysms. N Engl J Med 2002;346:1437-44.
3. Lederle FA, Wilson SE, Johnson GR, Reinke DB, Littooy FN, Acher CW, et al. Immediate repair compared with surveillance of small abdominal aortic aneurysm. N Engl J Med 2002;346:1437-44.
4. Lederle FA, Johnson GR, Wilson SE, Chute EP, Hye RJ, Makaroun MS, et al. Aneurysm Detection and Management Veterans Affairs Cooperative Study Investigators. The aneurysm detection and management study screening program validation cohort and final results. Arch Intern Med 2000;160:1425-30.
5. Brewster DC, Cronenwett JL, Hallett JW, Johnston KW, Krupski WC, Matsumura JS. Guidelines for the treatment of abdominal aortic aneurysm: report of subcommittee of The Joint Council of the American Association for Vascular Surgery and Society for Vascular Surgery. J Vasc Surg 2003;37:1106-17.
6. Valentine RJ, DeCaprio JD, Castillo JM, Modrall JG, Jackson MR, Clagett GP. Watchful waiting in cases of small abdominal aortic aneurysms–appropriate for all patients? J Vasc Surg 2000;32:441-50.
7. Treiman RL, Hartunian SL, Cossman DV, Foran RF, Cohen JL, Levin PM, et al. Late results of small untreated abdominal aortic aneurysms. Ann Vasc Surg 1991;5:359-62.
8. Ellis M, Powell JT, Place J, Mills S, Wolfe JNH, Boutlbee J, et al. The limitations of ultrasound in surveillance of small abdominal aortic aneurysms. Br J Surg 1991;78:614-6.
9. Pavone P, DiCesare E, Di Renzi P, Marsill L, Ventura M, Spartera C, et al. Abdominal aortic aneurysm evaluation: comparison of US, CT, MRI and angiography. Magn Reson Imaging 1990;8:199-204.
10. Multicentre Aneurysm Screening Study Group. The Multicenter Aneurysm Screening Study (MASS) into the effect of abdominal aortic aneurysm screening on mortality in men: a randomized controlled trial. Lancet 2002;360:1531-9.
11. UK Small Aneurysm Trial Participates. Health service costs and quality of life for early elective surgery or ultrasonographic surveillance for abdominal aortic aneurysm. Lancet 1998;352:1656-60.
12. Lindholt JS, Juul S, Fasting H, Henneberg EW. Hospital costs and benefits of screening for abdominal aortic aneurysms. Results from a randomized population screening trial. Eur J Vasc Endovasc Surg 2002;23:55-60.
13. Fleming C, Whitlock EP, Beil TL, Lederle FA. Screening for abdominal aortic aneurysm: a best-evidence systematic review for the US Preventive Services Task Force. Ann Intern Med 2005;142:203-11.
14. Brown LC, Powell JT, UK Small Aneurysm Trial Participants. Risk factors for aneurysm rupture in patients kept under ultrasound surveillance. Ann Surg 1999;230:289-97.
15. Vardulaki KA, Prevost TC, Walker NM, Day NE, Wilmink AB, Quick CR, et al. Growth rates and risk of rupture of abdominal aortic aneurysms. Br J Surg 1998;85:1674-80.
16. Lederle FA, Johnson GR, Wilson SE, Ballard DJ, Jordon WD Jr, Blebea J, et al. Veterans Affairs Cooperative Study No. 417 Investigators. Rupture rate of large abdominal aortic aneurysms in patients refusing or unfit for elective repair. JAMA 2002;287:2968-72.
17. Reed WW, Hallett JW Jr, Damiano MA, Ballard DJ. Learning from the last ultrasound: a population-based study of patients with abdominal aortic aneurysm. Arch Intern Med 1997;157:2064-8.

Submitted Jan 14, 2007; accepted Mar 13, 2007.

DISCUSSION

Dr Marc A. Passman (Nashville, Tenn). Drs Armstrong and associates should be complimented on an excellent presentation and well-written manuscript. Based on evidence-based guidelines and as carryover from their participation in the ADAM trial, a continued surveillance program was established at James A. Haley Veterans Hospital in Tampa, Florida, in 1998 for ongoing observation of small 4.0- to 5.4-cm abdominal aortic aneurysms (AAA). During the 8-year period, 473 patients were evaluated, of which 139 required operation for AAA exceeding 5.4 cm and 334 entered the surveillance algorithm for AAA of 4.0 to 5.4 cm. For those within the surveillance program, the authors report only two AAA ruptures (0.6%) during surveillance and a cumulative aneurysm-related mortality of 0.9% for those following the surveillance treatment algorithm. This leads me to several questions.

First, with a captive VA population, a high compliance rate of 98.5% is reported with the surveillance algorithm, which included CT or ultrasound imaging biannually. While such a compliance rate is commendable, it may be more difficult to reproduce outside the VA system. Although some recommendations are provided based on their VA experience, do the authors have any additional recommendations for success in the "real world," where cost and resources may be more problematic? After all, your group does not have a comparable program in the university arm of your practice.

Second, with a VA serving 8 counties and 436,000 veterans, the prevalence or incidence of AAA seems lower in this study than what would be expected in the general population with a similar risk profile, which suggests there are either patients with AAA who are not coming to your attention for enrollment or AAA is being under-diagnosed. Nationally, there is an increasing attention being placed on screening for AAA. What measures have the authors taken to combine their surveillance program with efforts at increased patient and provider awareness in their VA system to increase screening and identification of AAA, and thereby improve enrollment into the treatment and surveillance algorithm?

Third, for patients with AAA in the 4.0- to 5.4-cm range entering the surveillance program, 225 patients (67%) eventually required operative repair for size exceeding 5.4 cm or expansion exceeding 1cm/year, of which 143 (or approximately two thirds) underwent open repair and 82 (approximately one third), endovascular repair. With so many patients eventually requiring operation, was there any downside to delay now that the patients are older in terms of increased medical comorbidities compared to when they entered the program? How many of these patients were originally an endovascular candidate when entering the surveillance program but with AAA expansion are no longer?

Finally, the threshold size for operation used in the treatment algorithm is based on evidence based guideline related mostly to comparison of open repair and surveillance. While randomized trials comparing endovascular repair and surveillance for small AAA are still ongoing, early, nonrandomized data from our institution and others have suggested that endovascular repair of small AAAs is safe with low risk. Given that 67% of the patients in the surveillance program eventually required operation, were the authors able to retrospectively identify any factors that predicted expansion thereby supporting potential earlier AAA repair, especially for those who are endovascular candidates? Again, I congratulate the authors on their fine presentation and thank the Society for the privilege of discussing this paper.

Dr Paul A. Armstrong: In response to your first question, making the transfer of a surveillance program from a socialized system like the VA to private practice is indeed a challenge, but if we approach the problem by thinking outside of the box we can find some creative ways in which to create interest in these programs and defray cost; for example, regional societies and health management systems can be petitioned by their members or be coerced by cost savings to participate. Likewise, legislative pressure can be levied on third-party payers and health care systems to provide funding.

In answer to your next question, the primary care providers within the VA system have a health maintenance menu they complete at each patient visit. Beginning this year, there has been an addition to that menu that will include eligibility criteria for one-time abdominal aneurysm screening. This will provide a clinical reminder, if you will, for our primary providers and likely increase the effectiveness of aneurysm screening.

In this review, as in others supporting surveillance, aneurysm-related mortality was a relatively infrequent event. However, we know that despite operative repair preventing rupture, our older patients continue to die of other advanced conditions. In this series, we noted 21 cardiac and 10 cancer deaths within 3 years of AAA repair; therefore, the question for considering earlier AAA intervention is an important one. We did not perform a subset analysis of aneurysm morphology to determine if smaller aneurysms were more amenable to endovascular repair. Instead, we followed the size and growth parameters of the pathway to determine final operative options. Thus, I feel this review does little to support the concept of inviting earlier aneurysm repair.